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FOSSIL BIRDS FROM TERTIARY MARINE BEDS AT OCEANSIDE, SAN DIEGO COUNTY, CALIFORNIA With Descriptions of Two new Species of the Genera Uria & Cepphus (Aves: Alcidae)

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Running Head:
HOWARD, TERTIARY MARINE BIRDS

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OUTLINE

ABSTRACT

INTRODUCTION

METHODS AND MATERIALS

- Abbreviations
- Methods
- Materials

SYSTEMATICS

- San Luis Rey River Local Fauna
- Lawrence Canyon Local Fauna

CONCLUSIONS

ACKNOWLEDGMENTS

LITERATURE CITED

TABLES (3)

FIGURE TITLES

FIGURES (3)

ABSTRACT: The San Luis Rey River Local Fauna, in the lowermost rocks in Lawrence Canyon that are referred to the San Mateo Formation, yielded bones of six species of fossil birds: a murre, Uria paleohesperis n. sp.; a guillemot, Cepphus olsoni n. sp.; a flightless auk, Praemancalla cf. P. wetmorei; a loon, Gavia sp.; an albatross, Diomedea sp.; and an auklet, ?Aethia sp. The holotype of U. paleohesperis has shoulder and wing bones of stockier proportions than in Recent species of Uria, and has distinctive characters of the scapula, coracoid and ulna. The holotype humerus of C. olsoni is shorter than in Recent C. columba and has distinctive characters of the deltoid crest and ~~and~~ ectepicondylar process. The partial skeleton of Praemancalla cf. P. wetmorei includes the first leg bones known for the genus. In the Lawrence Canyon Local Fauna, higher in the formation, abundant fragmentary bones of Mancalla occur. Mancalla milleri, M. diegensis and M. cf. M. cedrosensis are recognized. The presence of Praemancalla in the lower beds and Mancalla in the upper indicates a major time interval within the San Mateo Formation at this Oceanside site, with a range from latest Miocene to earliest Pliocene.

INTRODUCTION

During the past several years the University of California Museum of Paleontology at Berkeley (UCMP) and the Natural History Museum of Los Angeles County (LACM) have collected vertebrate fossils in Lawrence Canyon in Oceanside, San Diego County, California. Over one hundred bird bones in these collections can be assigned to genus, and 13 taxa are recognized. Personnel of the San Diego Society of Natural History (SDSNH) also continue to collect in the area, and further reports are anticipated.

The Lawrence Canyon localities are at the extreme southern extent of Woodford's (1925:217) mapped outcrop of the San Mateo Formation, a rock unit which he grouped among "Post Capistrano formations." Later, Vedder (1972:167) suggested that Woodford's type section of the San Mateo Formation "may be a channel deposit within the lower part of the Capistrano Formation."

Tentatively retaining the San Mateo Formation designation, Barnes, Howard, Hutchison, and Welton (1981) recognized two separate local faunas based on the contained vertebrate fossils (See fig. 1). The faunal assemblage in the lowermost beds (fine gray to white sands that immediately overlie the San Onofre Breccia) was named the San Luis Rey River Local Fauna. The fossils referred to this fauna were collected at localities LACM 4297 (=UCMP V68147) and nearby localities LACM 4298 (=UCMP V68144) and LACM 4299 (=UCMP V68145). The fossil assemblage from a coarser sand and gravel matrix at locality LACM 4301 (=UCMP V68106) and UCMP V6880, some 25 feet higher and near the top of the exposed stratigraphic section, was named the Lawrence Canyon Local Fauna. Both local faunas were assigned to the Hemphillian North American Land Mammal Age, which spanned a period from

approximately 3.5 to 8.5 million years B P, and included the earliest Pliocene and latest Miocene epochs (Repenning and Tedford, 1977:Table 1). Bones of sharks, fish, birds, and terrestrial and marine mammals were found in both local faunas. The 26 bird bones from the lower horizon represent approximately half of the vertebrate fossil specimens recognized in the San Luis Rey River Local Fauna. These are assigned as follows (number of bones in parentheses):

Gavia sp. -- loon (1)

Diomedea sp. -- albatross (1)

Uria paleohesperis new species -- extinct murre (9)

Cepphus olsoni new species -- extinct guillemot (1)

?Aethia sp. -- auklet (1)

Praemancalla cf. P. wetmorei Howard -- extinct flightless auk (13)

The majority of the vertebrate bones in the Lawrence Canyon Local Fauna from the upper horizon represent flightless auks of the genus Mancalla Lucas 1901. The following avian taxa are recognized from this local fauna:

Family Sulidae -- booby or gannet (1)

Family Accipitridae -- eagle (1)

?Falco sp. -- falcon (1)

Cepphus sp. -- guillemot (1)

Mancalla milleri Howard -- extinct flightless auk (9)

Mancalla diegensis (Miller) -- extinct flightless auk (3)

Mancalla cf. M. cedrosensis Howard -- extinct flightless auk (12)

Mancalla sp. indet. -- extinct flightless auk (57)

4 & 5 are Introduction

original was retyped but is essentially the same as this

METHODS AND MATERIALS

ABBREVIATIONS

The following institutional acronyms are used for specimens cited in the text.

ANSP: Academy of Natural Sciences of Philadelphia

LACM: Natural History Museum of Los Angeles County

MVZ: Museum of Vertebrate Zoology, University of California, Berkeley

SDSNH: San Diego Society of Natural History, Natural History Museum

UCMP: University of California, Berkeley, Museum of Paleontology

USNM: United States National Museum

METHODS

The specimens illustrated were coated with a sublimate of ammonium chloride before photographing in order to present an evenly colored surface.

MATERIALS

FOSSIL. The following holotypes were available for this study: Mancalla milleri Howard 1970 (LACM 2185), M. cedrosensis Howard 1971 (LACM 15373), Praemancalla lagunensis Howard 1966 (LACM 15288), P. wetmorei Howard 1976 (LACM 42653), Uria brodkorbi Howard n. sp. (in press) (PB7960). Casts of the following holotypes were also available: Mancalla californiensis Lucas 1901 (USNM 4976), M. diegensis (Miller 1937) (UCMP 33409), Uria antiqua (Marsh 1870) (ANSP 13357), U. affinis (Marsh 1872) (ANSP 13358). The following referred material was examined: Australca sp., 11 ulnae from the Lower Pliocene Yorktown Formation, Lee Creek, North Carolina (USNM 177833, 179270, 179311, 181106, 183497, 192706, 206457, 210456, 215723, 215905, 242223); Miocepphus mcclungi Wetmore 1940, ulna (USNM 237219) from the Miocene Calvert Formation of Westmoreland County, Virginia, and humerus (USNM 25608) from the same formation in Maryland. In addition, large collections of avian fossils from the San Diego Formation (LACM and UCMP), the Almejas Formation (LACM), Monterey Formation (LACM) and Repetto Formation (LACM), containing specimens discussed herein, were at hand.

Included with the LACM and UCMP specimens from the San Mateo Formation in the discussions herein are 2 humeri (SDSNH 119165 and 23568) and a femur (SDSNH 21101) from the Oceanside locality collected by the San Diego Society of Natural History.

RECENT. All modern skeletal material of Recent species referred to herein is in the LACM collections, with the exception of specimens of the genus Aethia Merrem 1788, which were on loan from MVZ.

SYSTEMATICS

SAN LUIS REY RIVER LOCAL FAUNA

Wetmore + W.D. Miller 1926

Order GAVIIFORMES -- Loons

Family GAVIIDAE Forster 1788

Genus Gavia Forster 1788

Gavia sp.

REFERRED SPECIMEN: Left tarsometatarsus eroded distally, UCMP 88656. From locality V68145, collected by UCMP field party, Aug., 1968.

DESCRIPTION: In length the fossil tarsometatarsus is within the size range of tarsometatarsi of the living Pacific Loon, Gavia pacifica (Lawrence 1858 (66.2-75.3 mm, mean 70.1 mm) and close to that of the Red-throated Loon, Gavia stellata (Pontoppidan 1763) (68.9-71.4 mm, mean 70.2 mm), though below the mean for either (based on four specimens of each of the Recent species). Relative breadths of shaft and proximal end are within the range of G. pacifica, which slightly exceeds G. stellata in girth. The only notable character of the fossil specimen is found in the very high posterior position of the distal foramen, which is near the level of the proximal edge of the internal trochlea and 6.9 mm above the external intertrochlear notch. In G. pacifica and G. stellata the foramen is well below the proximal level of the internal trochlea and only 3.6-5.1 mm above the intertrochlear notch. Of five available specimens of the much larger G. immer (Brunnich 1764) the maximum distance of the foramen above the intertrochlear notch is only 6.4 mm.

MEASUREMENTS (in mm): Length to center of eroded middle trochlea 68.6, breadth of proximal end 12.0, least breadth of shaft 3.8, greatest depth of shaft 6.8.

DISCUSSION: Four extinct species of the genus Gavia have been recorded from the Tertiary of North America: Gavia brodkorbi Howard 1978 from the late Miocene Monterey Formation of California; G. palaeodytes Wetmore 1943 from the early Pliocene (Hemphillian) Bone Valley Formation of Florida; G. concinna Wetmore 1940 from the early-middle Pliocene Etchegoin Formation of California with referred material from the Bone Valley Formation and the late Pliocene San Diego Formation of California; and G. howardae Brodkorb 1953 from the San Diego Formation. A fifth species, G. portisi (Regalia 1901), is recorded from the Pliocene of Italy, based only on a cervical vertebra. Three modern species of loons are recorded from the Pleistocene of California (Brodkorb, 1963:225).

The tarsometatarsus has not been recorded for any of the extinct species. However, Robert Chandler of the San Diego Natural History Museum has called to my attention a small tarsometatarsus (SDSNH 22916) from the San Diego Formation that he is referring to G. howardae (Chandler ms). It bears the same size relationship to the tarsometatarsus of Recent G. stellata (14% shorter) as was previously observed (Howard 1978:5) for one of the referred humeri of G. howardae. Not only is it 8 mm shorter than the Oceanside specimen, it does not have the high position of the distal foramen. The very small size of the holotype ulna of G. brodkorbi, which is 23.6% shorter than the minimum for G. stellata (Howard 1979), suggests that this species also cannot be represented by the tarsometatarsus from the San Mateo Formation.

Those elements recorded for G. concinna and G. palaeodytes appear to fall within the size range of G. stellata and G.pacifica. Since this is also true for the Oceanside tarsometatarsus, it would be ill-advised to attempt a specific assignment of the specimen at this time.

Order PROCELLARIIFORMES Fürbringer 1888

Family DIOMEDEIDAE (Gray 1840) -- Albatrosses

Genus Diomedea Linnaeus 1758

Diomedea sp.

Typed in original

REFERRED SPECIMEN: Distal end of left tibiotarsus, LACM 119353, from locality LACM 4297. Collected by Robert M. McKenzie 9 March, 1979.

DESCRIPTION:

~~DISCUSSION~~: The fossil tibiotarsus resembles the comparable element in the Black-footed Albatross, Diomedea nigripes Audubon 1839, in having a slight notch on the distal surface of the internal condyle and a rounded contour of the external condyle (viewed laterally). The fossil is narrower in the area of the ligamental bridge and differs in relative depth to breadth of the distal end (depth of distal end 13.5 mm, anterior breadth of distal end 13.6 mm; the same dimensions in D. nigripes (LACM 86350) are 15.1 mm and 14.7 mm.

9] DISCUSSION: A number of albatross bones have been recorded previously from the Miocene of California, although only two species have been described: Diomedea californica Miller 1962 (a large form intermediate in size between the Recent D. exulans Linnaeus 1758 and D. albatrus Pallas 1769) and D. milleri Howard 1966 (a form notably smaller than D. nigripes). Both were described from the Middle Miocene Sharktooth Hill Bonebed in Kern County. Diomedea californica is also tentatively recorded from the late Miocene of Orange County (Howard 1978). Diomedea milleri, known only from the holotype ulna, appears to have been even smaller than the species represented by the tibiotarsus at hand, based on the comparable element of D. nigripes. Bones assignable to Diomedea, and apparently intermediate in size between the two described species, have been found in three California

late Miocene sites: in the Valmonte diatomite at Lomita, Los Angeles County (Miller 1935); and in the Monterey Formation in Laguna Hills, Orange County, at locality LACM 1945 (Howard 1968) and Laguna Niguel, Orange County, at localities LACM 6902 and 6906 (Howard 1978). A single species may be represented by these several occurrences, possibly including the Oceanside specimen.

Two other fossil species of Diomedea have been described: D. thryidata Wilkinson 1969 from the Miocene of Australia, known only from theholotype rostrum; and D. anglica Lydekker 1891 from the early Pleistocene of England (with referred specimens from the Pliocene of England and Florida (Brodkorb 1963:242). The Florida specimen of D. anglica is a tibiotarsus of much larger size than LACM 119353 from Oceanside. Extant species of the genus have been recorded from the Pleistocene of southern California (Brodkorb, 1963: 242).

Order CHARADRIIFORMES (Huxley 1867) -- Shorebirds

Family ALCIDAE Vigors 1825 -- Auk-like Birds

Subfamily ALCINAE (Vigors 1825)

Genus Uria Brisson 1760 -- Murres

DISCUSSION: The coracoid, ulna and radius of an incomplete skeleton (UCMP 88704) from locality UCMP V68147 more closely resemble the corresponding bones of Recent species of Uria than of any other Recent alcid genus, in the following characters: coracoid combining a prominent procoracoid and well-formed foramen with an anteroposteriorly narrow sternal facet; ulna with a stout olecranon, separated from the cotylar rim by a deep notch or channel (as viewed externally); and radius with the ulnar surface of the shaft above the distal end broad, and with a distinct, round ligamental attachment on the ligamental prominence. The associated scapula, however, has a narrower, less prominently projected glenoid facet than that of the murres or the closely related Razorbill (Alca torda Linnaeus 1758), and, in these characters, more closely resembles the murrelets of the genus Endomychura Oberholser 1899.

Although the scapula suggests generic distinction from Uria, I have chosen to place this incomplete skeleton in the genus Uria, in view of the similarities observed in the coracoid, ulna and radius.

Fig 2, a-f

Uria paleohesperis new species

HOLOTYPE: UCMP 88704, associated elements including articular end of right scapula, left and right coracoid (both lacking head), complete left ulna and distal end of right ulna, distal ends of left and right radius, distal end of left carpometacarpus, and wing phalanx digit II, phalanx 2. Collected by University of California Museum of Paleontology field party, August, 1968.

LOCALITY: UCMP V68147, Loretta Street, Lawrence Canyon, Oceanside, San Diego County, California.

FORMATION AND AGE: San Luis Rey River Local Fauna, San Mateo Fromation. Late Miocene.

ETYMOLOGY: The specific name is derived from the Greek palaeo--ancient, and hesperos--of the west, thus indicating an ancient western murre.

DIAGNOSIS: Distinguished from Recent species of Uria as follows: coracoid relatively stouter, with well-formed procoracoid more distinctly pointed at the tip, foramen small, and scapular facet deeply cup-shaped and sharply rimmed; scapula more concave dorsally between acromion and glenoid facet, acromion longer, and glenoid facet narrower and not markedly projected from shaft; ulna relatively stouter, with rounded shaft (less blade-like than in Uria), attachment of anterior articular ligament more broadly oval and flatter, and brachial impression broader, extending more than half the depth of the shaft; radius more distally attenuated on internal side of distal articulation; carpometacarpus poorly preserved, but contour of metacarpal 3 in symphysial region seemingly more rounded than angular; digit II, phalanx 2 less deeply

MEASUREMENTS: See Table I.

depressed posteriorly and with less sharply developed ridge anteriorly than that of U. aalge, closer to that of U. lomvia, but with ridge slightly more marked anteriorly; distinguished from extinct species of "Uria" antiqua (Marsh, 1870), U. affinis (Marsh, 1872), and U. brodkorbi Howard, 1981 by smaller size, and from U. brodkorbi by scapula being more concave dorsally and having narrower glenoid facet.

MEASUREMENTS : See Table 1.

DISCUSSION: The proximal end of a humerus (LACM 52018) from the late Miocene, Monterey Formation of Orange County, California, was assigned to ?Uria sp. (Howard, 1978). Although only a small fragment, it suggests the stockier proportions of the shaft, in comparison with humeri of Recent species of Uria, that are noted in the ulna of Uria paleohesperis. Possibly the same species is represented.

Four other extinct species of the genus Uria have been described: "Uria" antiqua (Marsh, 1870), from the Lower Pliocene of North Carolina, U. affinis (Marsh, 1872) from the Pleistocene of Maine, and U. ausonia Portis, 1887, from the Pliocene of Italy, each based on a humerus; and U. brodkorbi Howard, 1981 from the Miocene, Sisquoc Formation in California based on an incomplete skeleton. The small size of the elements of U. paleohesperis precludes their assignment to either U. antiqua or U. affinis, the holotypes of which are larger than humeri of living species of Uria. Furthermore, according to Olson and Gillette (1978), U. antiqua should be referred to the genus Australca Brodkorb, 1955, rather than to Uria. This may be

true, as well, of U. ausonia. Although the holotype humerus of U. ausonia is only a fragmentary distal end, the illustration (Portis, 1891:Tav. 1) that appeared subsequent to the original description suggests that the tricipital grooves are equal in size as in Alca torda Linnaeus, 1758 and Australca grandis Brodkorb, 1955. The external tricipital groove is notably narrower than the internal groove in the genus Uria. The holotype of U. brodkorbi consists of the impressions (in diatomite) of an incomplete skeleton, the wing and girdle elements of which are generally larger than those of U. paleohesperis. The details of the scapula are best compared in the two species. The scapula in U. brodkorbi resembles that of Recent species of Uria, and differs from that of U. paleohesperis in the greater breadth of the glenoid facet and less dorsal concavity.

Ulnae (USNM) from Lee Creek, North Carolina, which Olson (USNM, pers comm.) assigns to Australca, were loaned for this study. All have a more raised and distally pointed attachment for the anterior articular ligament than that of U. paleohesperis. This is also true of an ulna (USNM 237219) from the Miocene Calvert Formation of Virginia, which Olson (pers. comm.) assigns to Miocepphus mcclungi Wetmore, 1940. This ulna is also notably smaller and more curved than that of U. paleohesperis.

One species of murre, Uria aalge (Pontoppidan, 1763), occurs today as far south as Newport Beach, Orange County, California, and has been recorded from the Pleistocene of Los Angeles County (Howard, 1936)..

Genus Cepphus Pallas 1769--Guillemot

DISCUSSION: A humerus (LACM 107032) resembles that of the guillemots (genus Cepphus) as distinguished from all other genera of the family Alcidae in having a rounded, rather than compressed or bladelike shaft, that describes a broad S curvature from proximal to distal end as viewed both laterally and anconally.

Cepphus olsoni new species

Fig. 2 g, h

HOLOTYPE: Right humerus, LACM 107032. Collected by Robert M. McKenzie, 19 March 1975.

LOCALITY: LACM 4297, Loretta Street, Lawrence Canyon, Oceanside, San Diego County, California.

FORMATION AND AGE: San Mateo Formation; San Luis Rey River Local Fauna. Late Miocene.

ETYMOLOGY: The species is named in honor of Dr. Storrs L. Olson, of the National Museum of Natural History, in recognition of his extensive studies of fossil Alcidae.

DIAGNOSIS: Compared with the three living species of the genus (in increasing order of the size of the humerus), Cepphus grylle (Linnaeus, 1758), C. columba (Pallas, 1811) and C. carbo (Pallas, 1811). Between C. grylle and C. columba in length; relatively stouter of shaft; deltoid crest longer and less abruptly terminated distally; pectoral attachment shorter with surface concave and more clearly defined; bicipital surface distinctly bordered medially and raised from level of shaft; ectepicondylar prominence more evenly rounded in contour, lacking prominent proximal tip; tricipital grooves less distinct (bordering ridges less acute) than in C. grylle and C. carbo, closer to C. columba; shaft mediad of pectoral attachment sharply ridged, suggestive of condition in C. grylle, but space between ridge and median crest narrower and more depressed.

MEASUREMENTS: See Table II.

DISCUSSION: The genus Cepphus was tentatively recorded from locality LACM 6906 in the late Miocene Monterey Formation of Orange County (Howard 1978:21). While that specimen, an ulna (LACM 47045), suggests a species comparable in size to Cepphus olsoni, there is no clear indication that the different elements represent the same species. Apart from these two specimens there is no other previous fossil record of the genus Cepphus. In the material from the upper level of the San Mateo Formation, however, a fragment of a coracoid is herein identified as Cepphus sp. According to Storrs Olson (pers. comm.) Cepphus has not been found in the abundant alcid material known from the Miocene and Pliocene deposits of the western Atlantic.

That Cepphus olsoni is in no way related to Miocepphus mcclungi Wetmore 1940 from the Miocene Calvert Formation of Maryland is evident from the illustration of the holotype humerus of the latter species (Wetmore 1940:36, figs. 11 and 12), ~~as well as by~~ and the shaft measurements provided. The shaft in Miocepphus is more laterally compressed, the ectepicondylar process more prominent proximally, ~~and~~ the pectoral attachment more elliptical with space between attachment and median crest less sharply depressed than in the holotype of Cepphus olsoni. These observations are in keeping with an opinion previously provided by Olson (Howard, 1978:21) that he finds Miocepphus to be more closely related to Uria and Alca than to Cepphus.

as well as by comparison with another humerus (USNM 25668) from a nearby locality in the type formation which Storrs Olson (USNM, pers. comm.) refers to this species.

Genus Aethia Merrem 1788 -- Auklet

?Aethia sp.

REFERRED SPECIMEN: Left humerus lacking proximal end, LACM 107031, from locality LACM 4297. Collected by Lawrence G. Barnes, 19 March 1975.

DISCUSSION: This small auklet humerus resembles the humerus (LACM 18949) (Howard 1968:17) referred to Aethia rossmoori Howard 1968. The latter was collected from the type locality (LACM 1945) of that species in the late Miocene Monterey Formation of Laguna Hills, Orange County, California. It also resembles a humerus (LACM 37686) from a slightly later facies of the Monterey Formation in Orange County (locality LACM 6906) recorded (Howard 1978:21) as ?Aethia sp.

All three specimens differ from Recent specimens of Aethia pusilla (Pallas 1811) and A. pygmaea (Gmelin 1789) by having a more rounded shaft, a greater depression of the brachial area and of the attachment for the anterior articular ligament, and the latter attachment facing more palmad than laterad. Of the three fossils, only LACM 107031 is complete in the region of the tricipital ridges. It differs from specimens of Recent Aethia in that the internal tricipital groove is narrower than the external, and lacks the deep depression above the distal edge. In view of this notable distinction, plus the fact that several very small coracoids previously recorded from locality LACM 1945 (Howard 1968:17) have a well-developed procoracoid with well-formed foramen (unlike the short procoracoid and lack of a foramen characteristic of Recent Aethia), it is suggested that an extinct genus of murrelet or auklet is represented in the late Miocene. It is possible that even A. rossmoori

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(described from an ulna) should be generically reassigned. It is hoped that further finds of this small alcine will be forthcoming.

Measurements (in mm) of LACM 107031, with fossil humeri from Orange County, (LACM 18949 and LACM 37686, respectively) in parentheses: Breadth of distal end 5.0 (4.1; 5.3); least breadth of shaft 2.0 (1.8; 2.3); depth of shaft at same place 2.7 (2.6; 3.3); distance from distal condyle to proximal tip of ectepicondylar process 4.9 (4.5; 5.2).

Subfamily MANCALLINAE (Miller 1946) -- Extinct Flightless Auks

DISCUSSION: The subfamily Mancallinae is best known from the type genus, Mancalla Lucas 1901, in which the wing bones were modified as swimming paddles. Fossil bones of Mancalla are abundant in Pliocene deposits in southern California and are recorded herein from the Lawrence Canyon Local Fauna (see below). Prior records of the genus Praemancalla are restricted to the late Miocene Monterey Formation in Orange County. The generic name reflects its possible phylogenetic status relative to Mancalla, exemplified by wing bones less highly modified for swimming.

Genus Praemancalla Howard 1966

DISCUSSION: Two species of Praemancalla have been recorded from the Monterey Formation, Orange County, California: P. lagunensis Howard 1966 and P. wetmorei Howard 1976. The type locality (LACM 1945) of P. lagunensis represents a slightly earlier and stratigraphically lower facies of the Monterey Formation than that of P. wetmorei (locality LACM 6906). Only wing and shoulder girdle bones (with one fragment of mandible) have been previously identified for Praemancalla.

Praemancalla cf. P. wetmorei Howard 1976

REFERRED MATERIAL: Partial skeleton (LACM 107028) consisting of left ulna, left carpometacarpus, right tibiotarsus, left tarsometatarsus, left pedal digit II, phalanx 1, and thoracic vertebra 3. From locality LACM 4297, collected by Robert M. McKenzie, 19 March 1975.

DESCRIPTION: The ulna resembles the paratype of Praemancalla wetmorei (LACM 32429, and is distinguished from the ulna in the several species of Mancalla, in having (1) olecranon prominent, set off from the cotylae by a deep groove externally and a depression

internally (although in the paratype the depression is deeper and more pit-like than in LACM 107028; (2) brachial impression partially palmad and borderedby a heavy, long ridge; and (3) proximal radial depression broad. The distal end is distinguished from specimens of the several species of Mancalla by having a greatly enlarged projection overhanging the tendinal pit externally, and a deep groove separating the carpal tuberosity from the trochlea internally. The paratype of P. wetmorei lacks the distal end, but the length of the Oceanside specimen (36.7 mm) conforms well with the length of the previously referred radius of P. wetmorei (LACM 53907, 35.8 mm). Neither ulna nor radius is known for P. lagunensis.

The carpometacarpus resembles that of both species of Praemancalla, and is distinguished from all species of Mancalla, in having a distinct, blunt pisiform process and a more flared internal trochlear crest. It resembles the referred carpometacarpus of P. wetmorei (LACM 52216), and is distinguished from the paratype carpometacarpus of P. lagunensis (LACM 15287) by having a greater proximal extension of the trochlear crest above metacarpal I, a longer process of metacarpal I (proximodistally), and a less deeply depressed surface above the pisiform process. Distally it is distinguished from carpometacarpi of Mancalla by having a more posteriorly extended distal surface of metacarpal II toward M III, resulting in limited extent of the groove between metacarpal II and III distally. The available carpometacarpi of both P. wetmorei and P. lagunensis lack the distal end. The contours of the referred P. wetmorei specimen (LACM 52216), as compared with the complete bone from Oceanside, suggest that only 1 mm is lacking from the P. wetmorei

specimen, and that it was approximately equal in length to the one now at hand.

The tibiotarsus is similar to that of the several known species of Mancalla in its general shape and curvature, being relatively broader and flatter of shaft than that of species of the subfamily Alcinae, such as the murres (genus Uria) or the Great Auk, Pinguinus impennis. It is distinguished from tibiotarsi of Mancalla spp. by having a broader shaft which is less convex anteriorly below the cnemial crests, relatively longer cnemial crests, and more markedly flared distal end.

The tarsometatarsus is similar to that of Mancalla spp. in general shape, with the shaft's anterior surface depressed and bordered externally by a ridge. It is distinguished from tarsometatarsi of Mancalla spp. by the more abrupt narrowing of the shaft distal to the center; more broadly and evenly rounded anterior face of the shaft above the trochleae (lacking the acutely raised area proximal to the middle trochlea); more proximal position of the distal foramen, which is set in a shallower groove; and the more distal position of the internal trochlea. No leg bones have been previously recorded for either species of Praemancalla.

The pedal phalanx conforms in general characters to this element in Recent alcids, such as the murres (genus Uria), but is markedly larger: length 19.9 mm, proximal breadth 5.7 mm, distal breadth, 3.4 mm. The specimen articulates suitably with the internal trochlea of the tarsometatarsus of LACM 107028. This element has not been previously recorded for either Mancalla or Praemancalla.

The thoracic vertebra was compared with the 3rd thoracic vertebra of Mancalla cedrosensis Howard 1971 (LACM 15425 from locality LACM 65144), the best preserved of the available mancalline vertebrae. The Oceanside specimen resembles LACM 15425 and is distinguished from

thoracic vertebrae of Recent species of Uria in having a longer rib attachment and a straighter ventral border of the posterior articular surface of the centrum. Anteriorly, the articular surface of the centrum is broadly concave as in Mancalla and Uria, but it is distinct from both in having a greater dorsoventral dimension at the center. Measurements (in mm): length of centrum 11.9; anterior breadth of centrum 8.4; posterior breadth of centrum 6.5; posterior height of centrum 5.1. Same measurements in M. cedrosensis (LACM 15425): 10.0, 7.3, 4.9, and 4.2 respectively. No vertebra of either species of Praemancalla had been previously recorded.

See Table III for measurements of wing and leg bones of LACM 107028 compared with those available for the the two species of Praemancalla and the largest specimens of Mancalla diegensis.

TENTATIVELY REFERRED MATERIAL: From locality LACM 4297 and its equivalent, UCMP V68147: scapular end of coracoid (LACM (107030); synsacrum with incomplete pelvic bones of right side including acetabulum and antitrochanter (LACM 119406): axis vertebra (UCMP 102428). From locality LACM 4298 and its equivalent, UCMP V68144: right humerus, abraded distally and in the area of the internal tuberosity (LACM 107029); pedal digit III, phalanx 1 (UCMP 88640). From locality UCMP V68145: poorly preserved proximal end of left scapula (UCMP 95119); left femur poorly preserved both proximally and distally (UCMP 95118). A complete right femur (SDSNH 21101), with characters similar to those of UCMP 95118, was loaned for this study by the San Diego Natural History Museum (locality SDSNH 3003). Judging from the preservation of the specimen and its adhering matrix, it is from the lower level deposits of the San Luis Rey Local Fauna.

DESCRIPTION: Coracoid LACM 107030 resembles this element of Praemancalla and is distinguished from that of Mancalla by the more

medially, less posteriorly oriented triosseal canal, and the broad, flat coracohumeral attachment, which is not twisted anteriorly. The specimen is poorly preserved and the characters that distinguish P. wetmorei from P. lagunensis are not clearly observable. The only measurement possible (the span from the furcular facet to the top of the glenoid facet) agrees with this dimension in the referred coracoid of P. wetmorei (LACM 37637), 10.4 mm. The same dimension in the coracoid referred to P. lagunensis (LACM 15289) is 8.4 mm.

The scapula (UCMP 95119) is distinguished from that of the several species of Mancalla by the flatter, less concave ventral surface of the proximal end, and the longer, more distal extension of the acromion. These characters are suggested in the single, poorly preserved referred scapula of P. lagunensis (LACM 15294). The scapula has not been recorded previously for P. wetmorei. The proximal breadth of UCMP 95119 (13.8 mm) is greater than that of P. lagunensis (12.5 mm).

The following characters of the humerus (LACM 107029) agree with those attributed to the genus Praemancalla (Howard 1976:142): deltoid crest weakly developed; absence of papilla proximal to internal condyle; and presence of a groove separating the base of the ectepicondylar process from the external condyle. It is difficult to determine the profile of the capital groove because the internal tuberosity is broken away. The protrusion of the head over the groove, however, appears to be less than in Mancalla spp., and similar to the condition in Praemancalla wetmorei. The proximal end of the humerus is not known for P. lagunensis. The relative breadth to depth of the shaft above the distal end is 53%, as in P. wetmorei, contrasted with 66% in P. lagunensis. For measurements see Table III.

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The humerus (LACM 107029) has the weakly developed deltoid crest, absence of the papilla proximal to the internal condyle, and the presence of a groove separating the base of the ectepicondylar process from the external condyle characteristic of Praemancalla as contrasted with Mancalla (Howard, 1976:142). The relative breadth to depth of the shaft above the distal end is 53%, as in P. wetmorei, contrasted with 66% in P. lagunensis. It is difficult to determine the profile of the capital groove because the internal tuberosity is broken away. The protrusion of the head over the groove, however, appears to be less than in Mancalla spp., and similar to the condition in Praemancalla wetmorei. The proximal end of the humerus is not known for P. lagunensis. For measurements see Table III.

The two femora, SDSNH 21101 and UCMP 95118, undoubtedly represent the same species. SDSNH 21101 is complete; UCMP 95118 lacks the proximal surface and has eroded distal contours. Both show the mediad thrust of the distal end, suggestive of the holotype femur of Mancalla diegensis (Miller 1937). They are distinguished from this and all other species of Mancalla by the marked depression of the external side of the shaft adjacent to the fibular condyle, which results in emphasizing the prominence of the fibular and external condyles. The popliteal area is deeper than in M. diegensis, but resembles specimens of M. milleri Howard 1970 as well as those of the Great Auk, Pinguinus impennis (Linnaeus 1758), in this respect. The size of the femur is also similar to that of P. impennis. Proximally the head is large and tilted proximally; and the shaft recedes more abruptly from the head than in Mancalla diegensis or Pinguinus impennis. The shaft is depressed posteriorly adjacent to the obturator ridge, giving the ridge added prominence. Anteriorly, the trochanter is also prominent and deeply depressed along the internal edge, resembling in this respect the femur of Uria aalge, although the trochanter is longer in that species. Both obturator ridge and trochanter are more prominent than in Mancalla diegensis. For measurements, see Table III. The mancalline features of the femora and their size, which is proportionate to that of the tibiotarsus and tarsometatarsus associated with the wing elements herein assigned to Praemancalla cf. P. wetmorei, justify tentative assignment of the specimens to P. wetmorei. The ratio of the length of femur SDSNH 21101 to the length of tibiotarsus LACM 107028 assigned to P. cf. P. wetmorei, is 65.9%. The same ratio in the holotype skeleton of Mancalla cedrosensis Howard 1971 (LACM 15373) is 65.1%.

The synsacral section of the pelvis (LACM 119406) resembles a similarly preserved specimen assigned to Mancalla diegensis (LACM 2340) from the San Diego Formation in being generally heavier than that of members of the subfamily Alcinae, such as Uria aalge and Alca torda. It is, however, even heavier than that of M. diegensis (LACM 2340), and the median dorsal ridge is broader (greatest breadth of dorsal ridge 3.5 mm; 2.0 mm in LACM 2340).

The axis vertebra (UCMP 102428) was compared with an unrecorded axis of Mancalla diegensis (UCMP 45892) from the San Diego Formation. The Oceanside specimen has the facets of the postzygapophyses rounded in contour as ih M. diegensis, rather than oval as in the Recent murre, Uria aalge. These facets, are however, more concave than in M. diegensis and the sides of the vertebra are more deeply depressed toward the anterior end. In this latter respect the condition is more suggestive of that foundin Uria than in Mancalla. The specimen is markedly larger than M. diegensis UCMP 45892, and is in keeping with the large leg bones (LACM 107028) herein assigned to Praemancalla cf. P. wetmorei. Measurements (in mm): greatest length exclusive of the dorsal spine, 18.5 (M. diegensis UCMP 45892, 13.4); breadth and height of posterior surface of centrum, 3.1 and 5.5 respectively (UCMP 45892, 2.7 and 4.0).

The pedal digit III, phalanx 1 (UCMP 88640) suggests in general size digit II, phalanx 1 of the partial skeleton (LACM 107028) assigned herein to Praemancalla cf. P. wetmorei.

LAWRENCE CANYON LOCAL FAUNA

Order PELECANIFORMES Sharpe 1891

Family SULIDAE (Reichenbach 1849) -- Boobies and Gannets

Sulidae gen. and sp. indet.

REFERRED SPECIMEN: Digit II, phalanx 1, LACM 119312, from locality LACM 4301.

DISCUSSION: This incomplete phalanx resembles the comparable element in the gannet, Morus bassanus (Linnaeus 1758), in general characters, but is 2 mm broader.

Although the family Sulidae is no longer represented on the west coast north of Mexico, it is well recorded in the Tertiary and Quaternary of California (Brodkorb 1963:258-261). It is impossible to provide definite identification for this fragment.

Order FALCONIFORMES Seebohm 1890

Family ACCIPITRIDAE (Viellot 1816) -- Eagles and Hawks

Accipitridae gen. and sp. indet.

REFERRED SPECIMEN: Proximal end of pedal digit I, phalanx 1, LACM 119310, from locality LACM 4301.

DISCUSSION: In size this specimen suggests assignment to a small eagle or large hawk. Greatest breadth of proximal end is 13.2 mm; the same measurement in the Golden Eagle, Aquila chrysaetos (Linnaeus 1758), is 13.2 mm, and in the Ferruginous Hawk, Buteo regalis (Gray 1844), 11.9 mm. The shape of the proximal end more closely resembles that of the eagle.

Family FALCONIDAE (Vigors 1824) -- Falcons

Genus Falco Linnaeus 1758

?Falco sp.

REFERRED SPECIMEN: Fragment of right clavicle, UCMP 88597 from locality UCMP V6880.

DISCUSSION: This incomplete specimen is suggestive of a falconid clavicle in its prominent, round coracoidal facet. It is similar in size to that of a female Peregrine Falcon (Falco peregrinus Tunstall 1771, a species known in California today.

CORRECTION: Owing to a misunderstanding regarding the exact location of UCMP V6880, this specimen was cited as being from the San Luis Rey River Local Fauna in Barnes et al. (1981:61).

Order CHARADRIIFORMES (Huxley 1867) -- Shorebirds

Family ALCIDAE Vigors 1825 -- Auk-like Birds

Subfamily ALCINAE (Vigors 1824)

Genus Cepphus Pallas 1 769 -- Guillemots

Cepphus sp.

REFERRED SPECIMEN: Fragment of right coracoid including glenoid facet and portion of procoracoid, LACM 119260, from locality LACM 4301.

Typed correctly in original

DESCRIPTION:

~~DISCUSSION~~: The procoracoid is notched 4.6 mm below the upper surface, resembling in this character specimens of living Pigeon Guillemot, Cepphus columba Pallas 1811, a species known today off the coast of California. The few measurements possible on this fragment, compared to those of C. columba, are (in mm): length through glenoid facet and scapular facet 9.8 (8.7-9.1 in C. columba); depth from tip of procoracoid to shaft 7.8 (7.7-8.1 in C. columba). It is impossible to assess the relationship of this fragment to the new species, Cepphus olsoni, described herein from the lower level San Luis Rey River Local Fauna.

Subfamily MANCALLINAE (Miller 1946) -- Extinct Flightless Auks

Genus Mancalla Lucas 1901

DISCUSSION: Five species of Mancalla are known: M. californiensis Lucas 1901 from the early Pliocene (Repetto Formation) in Los Angeles, California, with 11 referred specimens (Howard 1949:196 and 1970:3) from the Repetto Formation in Corona del Mar, Orange County, California; M. cedrosensis Howard 1971, the holotype a nearly complete skeleton, and many referred specimens, all from the Almejas Formation (late Hemphillian) of Cedros Island, Baja California, Mexico; M. diegensis (Miller 1937) and M. milleri Howard 1970, both described and well represented by all principal skeletal elements from the late Pliocene, San Diego Formation in San Diego, California; and M. emlongi Olson (1981) from the San Diego Formation at Pacific Beach, San Diego County.

Eighty bones from locality L ACM 4301 and 1 from locality UCMP V68106 are assignable to this genus. Also available for this study were 2 complete humeri from locality SDSNH 2643 (equivalent of locality LACM 4301). Preservation of the LACM and UCMP material is poor, but the characters that distinguish Mancalla from Praemancalla are observable in the coracoids, scapulae, humeri, ulnae, radius, carpometacarpi, tibiotarsi and tarsometatarsi, as follows: coracoids with scapular facet placed laterally and triosseal canal posterointernally; scapulae concave ventrally, with short acromion, and glenoid facet projecting mediad; proximal ends of humeri with notch-like capital groove, and distal ends with papilla above distal condyles; ulna with olecranon not projecting proximad; radius bladelike; carpometacarpi without distinct pisiform process; tibiotarsi without flaring distal end; tarsometatarsi with anterior face of

of shaft depressed along external side, but raised above middle trochlea.

Several bones fall within the size range of the small M. milleri. The others are commensurate in size with those of M. diegensis, M. cedrosensis, and M. californiensis. Mancalla emlongi, known only from the holotype ulna, was apparently a larger species.

Twenty-six bones, including the two from SDSNH, are assigned, at least tentatively, to three species. The other 57 remain as Mancalla species indeterminate.

Mancalla milleri Howard 1970

REFERRED MATERIAL: From locality SDSNH 2643, complete humerus (SDSNH 23568); from locality LACM 4301, distal ends of 2 humeri (LACM 119166 and 119272), 2 ulnae (LACM 119283 and 119286), incomplete radius (LACM 119292), proximal end of carpometacarpus (LACM 119290) and proximal ends of 3 scapulae (LACM 119262, 119264, 119265).

typed in as original → DESCRIPTION: ~~DISCUSSION~~: The complete humerus agrees in size with that of M. milleri. Measurements (in mm): length to internal condyle 62.7 (M. milleri 56.4-66.6), proximal breadth 15.7 (M. milleri 14.2-16.4), distal breadth 6.0 (M. milleri 5.1-6.0). It also has the additional character of the angular distal contour of the bicipital crest which distinguishes it from the humerus of M. cedrosensis. The other specimens are assigned entirely on the basis of small size. Measurements (in mm): distal breadths of humeri 5.4 and 5.7, proximal breadths of ulnae 5.3 and 5.5 (M. milleri 4.5-5.7) greatest shaft depth of radius 5.3 (M. milleri 4.6-5.6), proximal depth of carpometacarpus through metacarpal I 8.8 (M. milleri 8.8-9.3), proximal breadth of complete scapular end 11.6 (M. milleri 10.2-11.8).

Mancalla diegensis (Miller 1937)

REFERRED MATERIAL: From locality SDSNH 2643, complete left humerus (SDSNH 23567); from locality LACM 4301, 2 proximal ends of humeri (LACM 119301 and 119276). An ulna (LACM 119279) is tentatively referred.

typed in original

~~DISCUSSION~~ DESCRIPTION: The complete humerus has the very angular distal contour of the bicipital crest characteristic of Mancalla diegensis, M. milleri and M. californiensis, and is further distinguished from M. cedrosensis by the broader, more shallow area below the head. It is distinguished from M. milleri by larger size and from M. californiensis by the muscle scar at the median border of the pneumatic fossa, which does not protrude into the fossa as a distinct groove (Miller and Howard, 1949:209). Although incomplete, the two proximal fragments have the small scar at the distal edge of the bicipital crest which provides the angular contour of the crest as noted above.

The olecranon of the ulna is incomplete, but appears to be straighter in anconal contour than in M. cedrosensis, and the adjacent depression is small.

typed in original

MEASUREMENTS

Measurements (in mm) compared with those of M. diegensis (Howard 1970:Table III): Humerus (SDSNH 23567), length to internal condyle, 75.9, proximal breadth, 18.9 (M. diegensis, 71.0 -85.2 and 17.3-20.3 respectively); ulna (LACM 119279), length 31.7 (M. diegensis 28.0-32.1), proximal breadth 6.1 (M. diegensis 5.9-6.6).

Mancalla cf. M. cedrosensis Howard 1971

REFERRED MATERIAL: From locality 4301: a nearly complete, but poorly preserved humerus, LACM 119165; proximal ends of 5 humeri, LACM 119222, 119224, 119269, 119273, 119372; complete tarsometatarsus, LACM 119298, and shaft of tarsometatarsus, LACM 119174. In addition, 4 complete ulnae, LACM 119280, 119281, 119287, 119288 are tentatively referred.

typed in original

DESCRIPTION

~~DISCUSSION~~: The humeri resemble this element of M. cedrosensis and are distinguished from those of M. diegensis, M. milleri and M. californiensis by the characters described (Howard 1971:12) for the holotype of M. cedrosensis (LACM 15373): ". . internal contour from shaft through bicipital crest broadly and gradually curved; area below head between pectoral attachment and pneumatic fossa oval and deeply depressed." All are within the size range for M. cedrosensis except LACM 119372, which falls between M. cedrosensis and M. milleri in proximal breadth (16.6 mm in LACM 119372; M. milleri maximum 16.4; M. cedrosensis minimum 17.0 mm).

The complete tarsometatarsus has the proximal and distal flaring as in both M. cedrosensis and M. diegensis, as contrasted with the more columnar shape in M. milleri. In both LACM 119298 and the incomplete LACM 119174, the shaft is more depressed anteriorly than in either M. diegensis or M. californiensis, and both borders of the anterior face of the shaft are sharply defined as in M. cedrosensis. Length (in mm) of LACM 119298, 41.1, proximal breadth 10.1 (same measurements in M. cedrosensis, 37.3-42.0 and 9.9-10.9 respectively).

In the tentatively referred ulnae the olecranon extends beyond the shaft in anconal contour and there is a deep depression adjacent to the olecranon on the internal side as in M. cedrosensis. The depression is also present in the ulnae of M. milleri, but the olecranon is less protruded in the smaller species. The four Oceanside specimens fall within the sizæ range of M. cedrosensis in length (28.3-30.7 mm; M. cedrosensis 28.3-31.7 mm), but are somewhat more slender.

Mancalla species indeterminate

REFERRED MATERIAL: From locality UCMP V68106, incomplete left coracoid, UCMP 88614. From locality LACM 4301, 20 fragmentary humeri, LACM 119167-119171, 119268, 119270, 119271, 119274-119278, 119302-119306, 119407, 121530; 6 incomplete ulnae, LACM 119282, 119284, 119285, 119289, 119311, 119408; 2 carpometacarpi, LACM 119291, 121530; 9 fragments of coracoids, LACM 119223, 119253-119259, 119307; 6 proximal fragments of scapulae, LACM 119172, 119261, 119263, 119266, 119267, 119373; 6 fragments of tibiotarsi, LACM 119173, 119178, 119294-119296, 119371, 121531; 3 fragments of tarsometatarsi, LACM 119297, 119299, 119300; 1 wing phalanx, LACM 119293; 2 pedal phalanges, LACM 119308, 119309; 1 thoracic vertebra, LACM 119252.

DISCUSSION: These fragments probably represent one or more of the species herein specifically assigned within the genus, but it would be ill-advised to attempt to assign them to species.

CONCLUSIONS

This study of the avifaunas of the San Mateo Formation at Oceanside has resulted in the recognition of two new species of the family Alcidae, Cepphus olsoni and Uria paleohesperis, from the San Luis Rey River Local Fauna in the lower level of the formation. Both species add support to the tentative earlier record (Howard 1978) of the genera Cepphus and Uria from the slightly older late Miocene Monterey Formation located farther north, in Orange County, California. The only other confirmed Tertiary record of the murres, genus Uria, is from the late Miocene Sisquoc Formation, near Lompoc, California (Howard in press). The guillemots, genus Cepphus, have no prior fossil record. A loon (genus Gavia), an albatross (genus Diomedea) and a murrelet (genus ?Aethia) are also known from both the Monterey Formation of Orange County and the lower part of the San Mateo Formation, although there is no proof of specific identities.

Of greater significance is the occurrence of the extinct flightless auk genus Praemancalla in both the lower level of the San Mateo Formation at Oceanside and in the Monterey Formation in Orange County. The partial skeleton from Oceanside is assigned to P. cf. P. wetmorei, the species described from the uppermost Monterey Formation at locality LACM 6906. The Oceanside specimen includes wing elements, previously recorded for the species, associated with the first tibiotarsus and tarsometatarsus known for the genus. In addition, 2 isolated femora are the first of this element assigned to Praemancalla.

In the Lawrence Canyon Local Fauna, in the upper part of the San Mateo Formation at Oceanside, the predominance of the genus Mancalla is typical of the marine Pliocene of California. Although it was impossible to specifically identify all of the more than 80 specimens recorded here, three species are noted: M. milleri and

M. diegensis (the predominant species of the late Pliocene, San Diego Formation) and M. cedrosensis of the latest Miocene to early Pliocene (Repenning and Tedford 1977) of Cedros Island, Baja California, Mexico. The additional fragmentary records from the upper beds add little to the picture, except that the presence of eagle and falcon suggests near-shore deposition.

The occurrence of the highly specialized flightless auk genus Mancalla in the upper part of the San Mateo Formation and the related, but more primitive Praemancalla in the lower part of the stratigraphic section is important in providing information as to the relative ages of the beds at the two levels. Mancalla is the most abundantly represented genus of fossil birds in the Pliocene marine formations (including part of the Capistrano Formation) of the southwest coast. One specimen has also been recorded (Howard 1970) from Humboldt County in Northern California, in beds purported to be as young as Pleistocene in age (Kohl 1974) with an amino-acid age estimate of 470,000 years B P (Wehmiller et al. 1979). Praemancalla, on the other hand, has been recorded previously only from the late Miocene Monterey Formation. If Vedder's (1972:167) postulation that the San Mateo Formation may be a channel deposit within the Capistrano Formation is correct, it is not surprising to find Praemancalla in these lowermost beds. For, as he also notes (Vedder 1972:165-166), in its type area the Capistrano Formation is in gradational contact with the underlying Monterey Formation, indicating that there may be no hiatus between these formations. It would appear that the interval between the lower and upper stratigraphic levels of the San Mateo Formation could be of considerably greater extent, allowing

time for the demise of the genus Praemancalla and the evolution of Mancalla.

Since the upper part of the Monterey Formation is of Clarendonian age, ranging roughly from 8.5 to 12 million years B P, and the lower parts of both the San Mateo and Capistrano Formations are early Hemphillian in age, the geochronologic age of Praemancalla is now extended from the Clarendonian into the Hemphillian age.

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Table I. Measurements (in mm) of Uria paleohesperis n. sp. compared to Recent Uria aalge californica (7 specimens)

	Uria paleohesperis	U. a. californica max.	mean	min.
Scapula				
Breadth proximal end	10.6	11.5	11.1	11.0
Glenoid facet, length	5.9	5.7	5.5	5.0
Glenoid facet, breadth	3.7	4.3	3.8	3.6
Shaft near prox. end				
Breadth	4.3	5.2	4.6	4.1
Depth	2.5	2.25	2.15	2.1
Coracoid				
Length from sternal facet to lip of scapular facet	23.4	26.4	25.0	24.3
Breadth of shaft at level of foramen	4.8	4.7	4.5	4.4
Breadth sternal end	14.6	16.2	15.1	14.6
Depth of sternal facet	4.5	5.1	4.5	4.2
Ulna				
Greatest length	62.6	69.5	65.3	61.3
Breadth proximal end	8.5	8.6	8.3	8.1
Depth proximal end internally	9.7	10.15	9.9	9.8
Middle shaft, breadth	3.85	4.3	4.0	3.8
Middle shaft, depth	5.35	6.6	6.1	5.75
Greatest breadth of brachial impression	3.5	3.4	2.9	2.6
Radius				
Breadth of distal end	5.7	5.9	5.7	5.6

Table 11. Measurements (in mm) and ratios (in per cent) of humeri of Cepphus olsoni n. sp. and C. columba (3 specimens)

	Cepphus olsoni	Cepphus columba
Greatest Length ~~to internal condyle~~	61.6	66.2-69.2
Breadth of proximal end across bicipital crest	15.4	14.7-15.1
Breadth of distal condyles	7.1	~~7.4-~~ 7.9
~~Breadth of shaft~~ Depth from anconeal & pectoral (middle)	~~3.8~~	~~3.4-~~ 3.8
~~Depth~~ Breadth of shaft (middle)	4.8	4.6- 5.1
~~Ratio of breadth to depth of shaft~~	~~79.1~~	~~73.9-74.5~~
delete Ratio of breadth to length of pectoral attachment	~~50.0~~	~~38.0-40.6~~

sahft mediad of pectoral attachment sharply ridged, suggestive of condition in C. grylle, but space between ridge and median crest narrower and more depressed.

Table II. Measurements (in mm) and ratios (in per cent) of humeri of *Cepphus olsoni* n. sp. and *C. columba*

	Cepphus olsoni	*Cepphus columba*
Length to internal condyle	61.6	66.2-69.2
Breadth of proximal end across bicipital crest	15.4	14.7-15.1
Breadth of distal condyles	7.1	7.4- 7.9
Breadth of shaft (middle)	3.8	3.4- 3.8
Depth of shaft (middle)	4.8	4.6- 5.1
Ratio of breadth to depth of shaft	79.1	73.9-74.5
Ratio of breadth to length of pectoral attachment	50.0	38.0-40.6

Table 2. Measurements (in mm) and ratios (in per cent) of humeri of *Cepphus olsoni* n. sp. *C. grylle* (2 specimens) and *C. columba* (3 specimens).

	C. olsoni	*C. grylle*		*C. columba*	
		female	male	min.	max.
Greatest length	61.6	59.8	60.6	66.2	69.2
Breadth of proximal end across bicipital crest	15.4	14.4	14.0	14.7	15.1
Breadth of distal end through condyles	7.1	7.0	7.1	7.4	8.0
Breadth of shaft (middle)	4.8	4.3	4.0	4.3	4.8
Depth of shaft from anconal to palmar surface (middle)	3.8	3.4	3.4	3.4	3.7
Ratio breadth of shaft to length of humerus	7.8	7.2	6.6	6.5	6.9

Table III. Measurements (in mm) of Oceanside *Praemancalla* bones* and those of *P. wetmorei*, *P. lagunensis* and *Mancalla diegensis* (maximum).

	Praemancalla Oceanside	*Praemancalla wetmorei*	*Praemancalla lagunensis*	*Mancalla diegensis*
Humerus				
Length to intercondylar sulcus	80.8	81.1	----	83.4
Proximal breadth	20.5	22.2	----	20.3
Greatest depth of shaft	9.8	9.6	7.7	10.3
Breadth shaft (same place)	5.2	5.1	5.1	5.2
Ulna				
Length to intercotylar ridge	36.7	----	----	32.0
Proximal breadth	7.5	7.5	----	6.6
Proximal depth	11.0	11.3	----	9.3
Breadth shaft (middle	4.4	4.2	----	3.9
Depth shaft (middle	6.6	6.2	----	6.8
Carpometacarpus				
Length	36.3	36.3(est)	----	37.2
Breadth proximal trochlea	5.2	5.3	5.2	4.7
Depth proximal thru M 1	11.8	12.1	11.7	11.0
Length process of M 1	15.2	15.7	14.0	15.5
Breadth of shaft	4.0	4.0	4.5	3.7
Femur				
Greatest length (external)	69.3	----	----	57.0
Distal breadth	14.4	----	----	11.1
Proximal breadth	14.6	----	----	11.7
Tibiotarsus				
Length to proximal articular surface	105.1	----	----	98.5
Distal breadth	13.5	----	----	10.7
Distal depth	12.1	----	----	9.7

LEGENDS FOR FIGURES

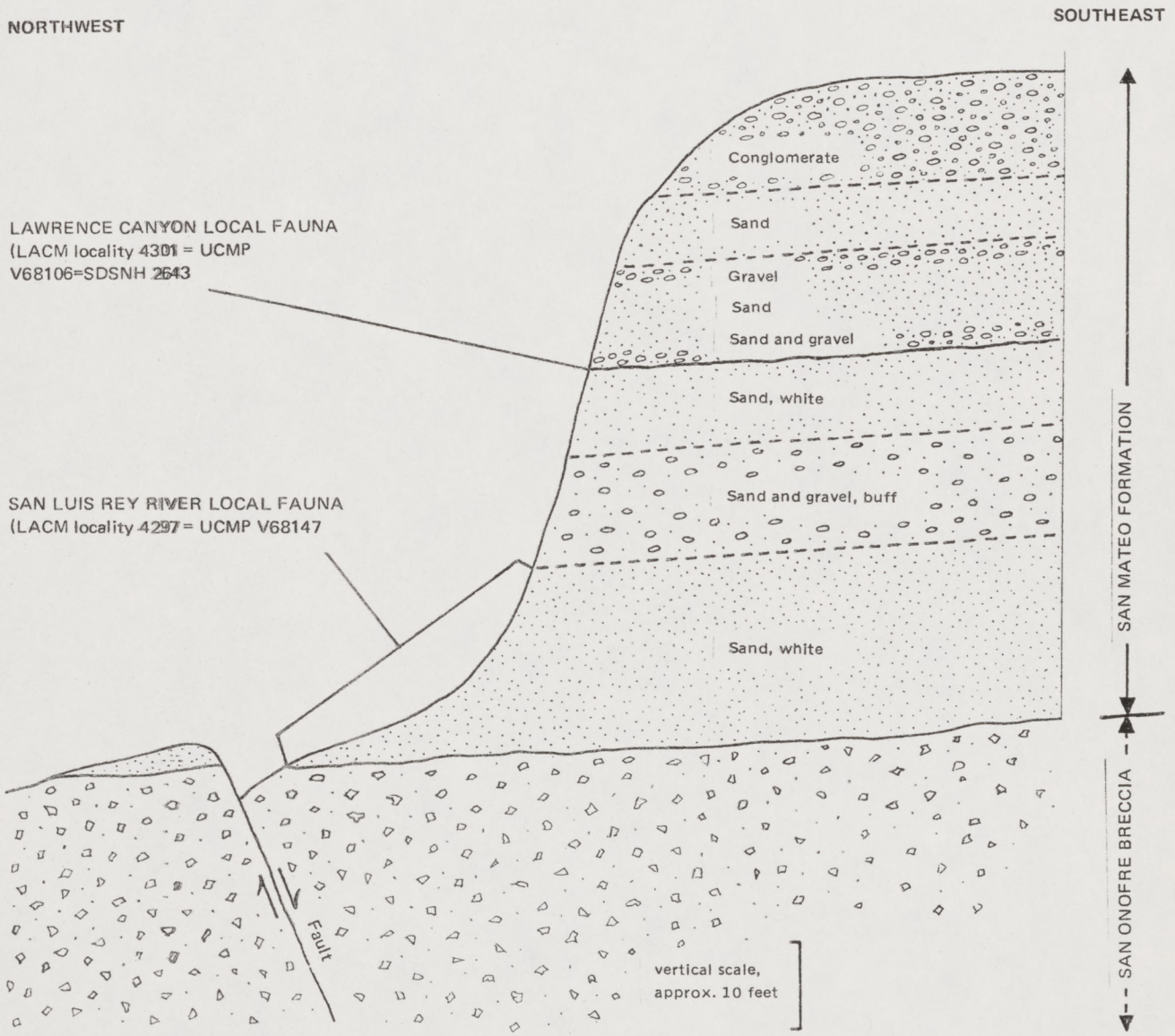
Figure 1. a - f, Uria paleohesperis n. sp., holotypic material, UCMP 88704: a, b, external and internal views of left ulna; c, dorsal (posterior) view of right coracoid; d, external view of distal end of left carpometacarpus; e, palmar view of distal end of left radius; f, dorsal view of right scapula; g, h, Cephus olsoni n. sp., holotype humerus LACM 107032, anconal and palmar views.

Figure 2. Praemancalla cf. P. wetmorei, a-e and g-i, LACM 107028; f, j, k, SDSNH 21101. a, carpometacarpus, internal view; b, c, ulna internal and external views; d, e, tarsometatarsus, posterior and anterior views; f, j, k, femur, external, anterior and posterior views, g, h, i, tibiotarsus, internal, anterior and external views.

Figure 1. Diagrammatic geologic cross section of part of the San Mateo Formation and the San Onofre Breccia exposed in Lawrence Canyon at Oceanside, showing the stratigraphic occurrences of some fossils comprising the two local faunas. Relative thicknesses of the beds are estimated, and the amount of displacement on the fault has not been measured. Modified from Barnes et al 1981:fig. 1. Based on notes and sketches by Barnes made in the field. There is an unconformity at the contact between the San Mateo Formation and the San Onofre Breccia, and another within the San Mateo Formation at the base of the sand and gravel bed that produced the Lawrence Canyon local Fauna

Howard: Fossil Birds, 81-5
REVISED LEGEND FOR FIGURE 1

Figure 1. Diagrammatic geologic cross section of part of the San Mateo Formation and the San Onofre Breccia exposed in Lawrence Canyon at Oceanside, showing the stratigraphic occurrence of some fossils comprising the two local faunas. Relative thicknesses of the beds are estimated, and the amount of displacementon the fault has not been measured. There is an unconformity at the contact between the San Mateo Formation and the San Onofre Breccia, and another within the San Mateo Formation at the base of the sand and gravel bed that produced the Lawrence Canyon Local Fauna. Modified from Barnes et al, 1981:fig. 1. Based on notes and sketches made in the field by Barnes.


NORTHWEST
SOUTHEAST
LAWRENCE CANYON LOCAL FAUNA
(LACM locality 4301 = UCMP
V68106=SDSNH 2643
SAN LUIS REY RIVER LOCAL FAUNA
(LACM locality 4297 = UCMP V68147
Conglomerate
Sand
Gravel
Sand
Sand and gravel
Sand, white
Sand and gravel, buff
Sand, white
Fault
vertical scale,
approx. 10 feet
SAN MATEO FORMATION
SAN ONOFRE BRECCIA

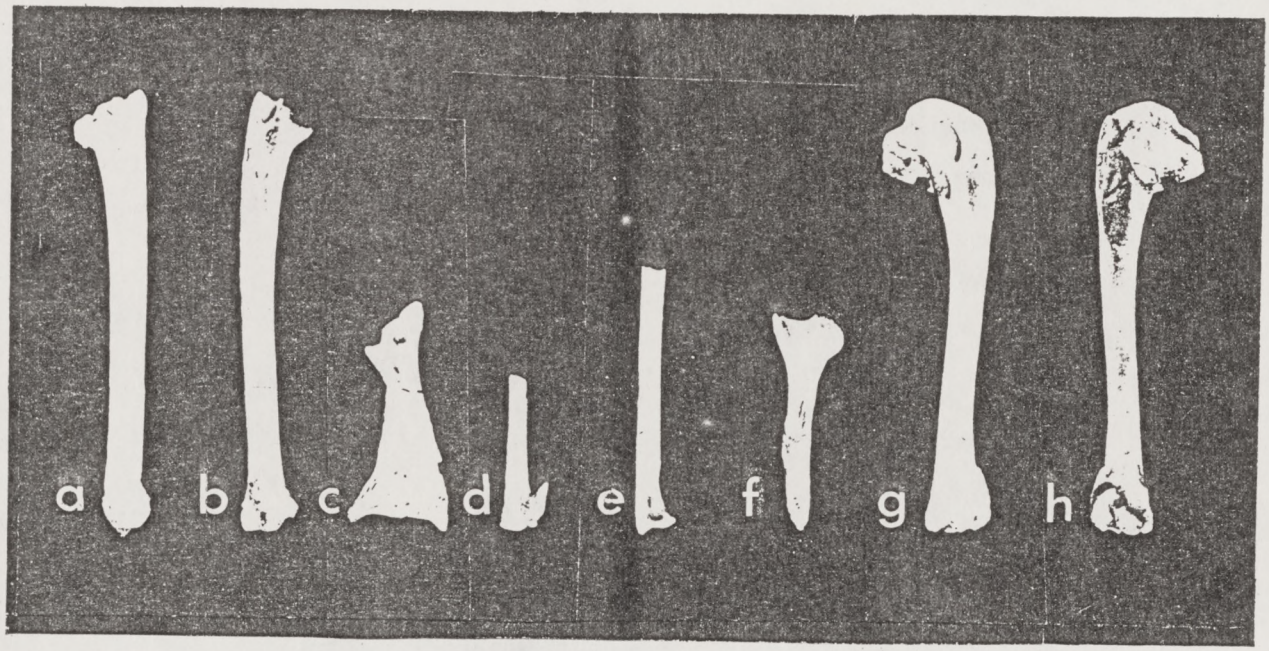


Fig. 9 Xerox comic layout
a and b are being retouched

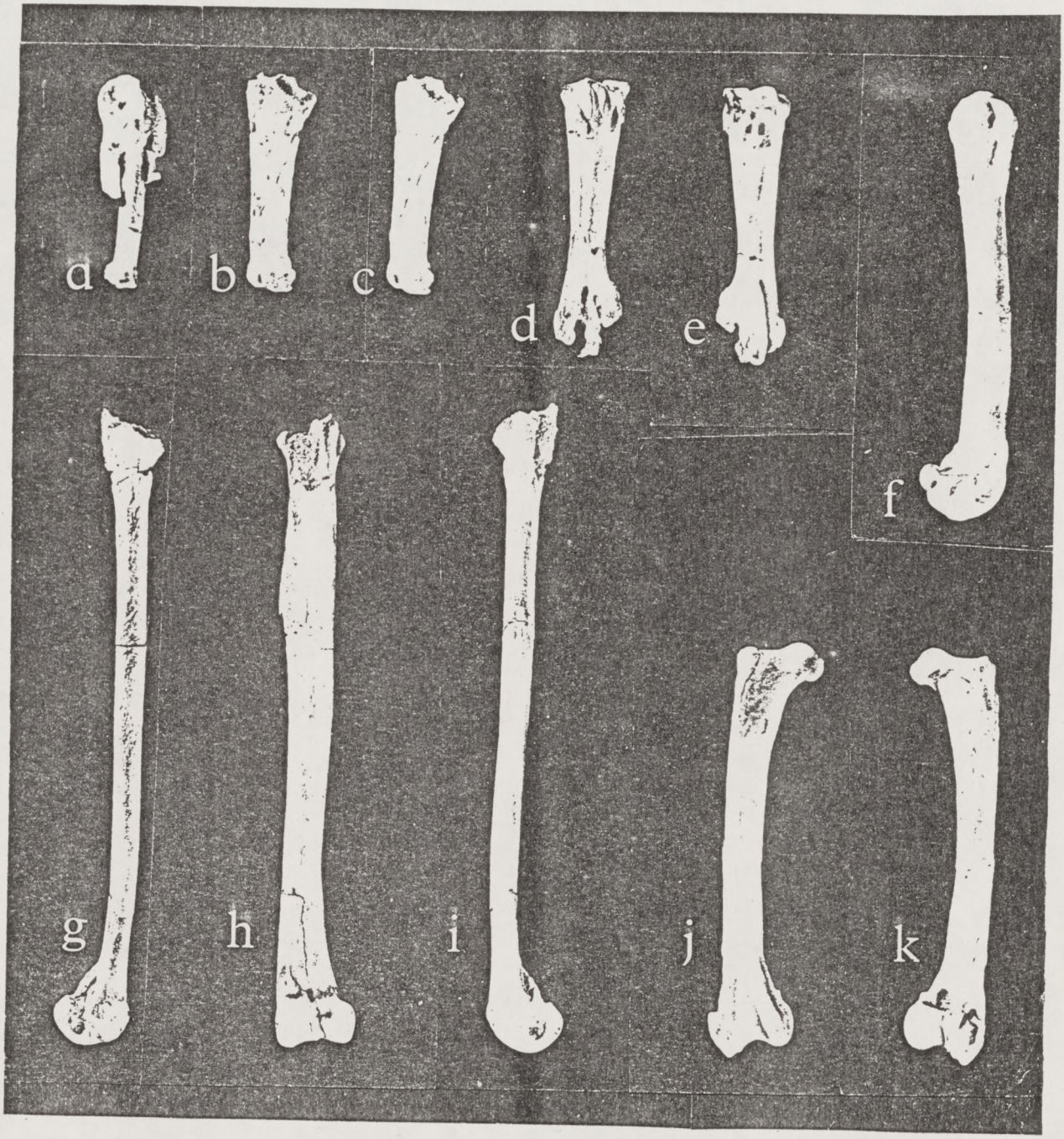


Fig. 3 (xerox copies layout
c will be re photographed as external view

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